alternating DC potentials are applied, acts as an ion guide which continuously focuses toward the axis if ions transit this arrangement with sufficient velocity, either by virtue of their own inertia or when driven by a gas. The potential barrier can then be generated by one of the apertures within the arrangement, or by a further aperture behind this arrangement.

[0075] In order to then increase (or decrease) the lateral guidance force of the ion guides when the opposing fields at the potential barrier change, the voltages at the ion guides can be changed in synchronization with the voltage of the potential barrier. Care must be taken here that the ion current is not changed so much by the change to the lower mass threshold of the ion guides that, after differentiation, false ion mobility signals are generated. This can particularly happen when there are stronger ion signals in the lower mass range which suddenly appear or disappear when the lower mass threshold is changed. Since the light ions of the lower mass range up to 500 daltons, for example, usually contribute nothing at all to the mobility spectrum, it is advantageous to filter out the light ions before they reach the potential barrier. In arrangements according to FIG. **1** or **2**, which each have two ion funnels, this filtering out can be done in the first ion funnel, for example, by a potential barrier at the ring diaphragm (**6**), i.e. according to the method of J. S. Page et al.

[0076] Instead of increasing the RF voltages at the ion guides, the frequency of the RF voltage can be decreased. This measure also improves the guiding of heavier ions, as is known for pseudopotentials.

[0077] If the potential barrier in FIG. **2** is raised by increasing the voltage at the diaphragm aperture (**9**), the velocity of the ions, which they possess on entering the next ion guide system (**11**), can change. They can receive this velocity when rolling down from the potential barrier if the gas density is not high enough to reduce this velocity immediately back to the velocity of the gas by the damping action in the gas. Differing velocities can, however, change the acceptance of the ion guide (**11**) with respect to the ions entering, and thus change the ion current as a whole. Since the acceptance is mass-dependent, the ion current can even change as a function of the mass. In order to exclude such a change in the acceptance resulting from a changing potential difference between diaphragm (**9**) and ion guide (**11**), it is possible to jointly change all the voltages at the instrument parts (**5**), (**6**) and (**8**) in front of the ring diaphragm (**9**) instead of changing the voltage at the diaphragm (**9**). It is also possible to couple the changes to all voltages at the instrument parts behind the ring diaphragm (**9**) to the voltage at the ring diaphragm (**9**) itself.

[0078] The acquisition methods for mobility spectra can be calibrated by ions whose mobilities are known. The calibration function $K_0=f(V)$ as a function of the height V of the potential barrier turns out to be virtually linear over wide ranges. After calibrating an acquisition method, the mobility spectra can be converted from potential barrier coordinates V to mobility coordinates K_0. From these calibrated spectra, the values K_0 for the mobilities of the individual ion species and the mobility resolution $R_{mob}=K_0/\Delta K_0$ of the method can be determined.

[0079] For comparisons of measured mobilities with computed mobilities for different conformations of one ion species, it is advantageous to use monoatomic helium as the drift gas because the calculations become simpler. The helium can be used as the curtain gas in an electrospray ion source, passing together with ions through an inlet capillary and into the vacuum system, where the differential evacuation forms it into a jet of gas through the ion guides.

[0080] If no such comparison of measured and computed mobility values is planned, nitrogen, clean air or other gases can be used as the curtain gas in the electrospray ion source and for the formation of the jet of gas. For calibrations, in particular, it must be remembered that nitrogen and other gases produce mobility values which are different to those for helium. Another advantageous gas for mobility measurements is argon.

[0081] The gas, from which ultimately the gas jet according to the invention is formed, is in most cases added in the electrospray ion source as curtain gas. It accepts the ions and guides them through the inlet capillary into the first stage of the vacuum system. The curtain gas is usually heated to around 200 to 300 degrees Celsius in order to contribute to the desolvation of the ions in the capillary; the gas is greatly cooled in the inlet capillary itself, and particularly in the transitions of the differential pumping stages. It has also been elucidated, however, that the curtain gas can be greatly cooled, for example down to the temperature of liquid nitrogen, before being introduced into the inlet capillary. Cooled curtain gas can contribute to an increase in the mobility resolution of the method according to the invention. The temperature of the curtain gas can also be used to investigate temperature-dependent conformational changes of the ions as a result of changes to the folding, however.

[0082] The gases which form the gas jet by emerging from an aperture into the surrounding vacuum can also be added later, at a different location along the path of the ions from the ion source to the ion detector. Some mass spectrometers already have such gas feeds, which are used to fill collision cells for the fragmentation of ions. These collision cells generally take the form of ion guides, and can therefore be used according to the invention for mobility investigations.

[0083] For ion mobility measurements in long drift regions, a pressure range of a few hectopascals is usually selected. The acquisition times for a mobility spectrum then amount to a few hundred microseconds. However, according to the equation given above for the part of the mobility resolution determined by the diffusion, the mobility resolution does not depend at all on the pressure. One could therefore apply lower pressures without any disadvantage. But at lower pressures, the drift velocity is higher, which makes the acquisition time for a mobility spectrum so short that only very fast and expensive transient recorders can be used to measure the ion currents.

[0084] These considerations do not apply to mobility measurements with methods according to this invention. The mobility resolution seems rather to increase at lower pressures, possibly because the velocity of the adiabatically cooled gas jet is more homogeneous; or even as a result of the formation of a gas jet with the speed of sound. At the end of the second ion funnel (**8**) from FIG. **1**, there is a pressure of between a few pascals and a few tens of pascals only. Methods according to the invention can therefore preferably be carried out at pressures below a few tens of pascals.

[0085] The advantage of the methods and instruments according to the invention is the combination of the relatively high mobility resolution and compact size of the necessary devices. A further advantage is that the necessary devices can easily be incorporated into a mass spectrometer. A number of mass spectrometers even already have the necessary devices in a readily usable form.